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TECHNOLOGY AND HANDICAPPED PEOPLE

Working Paper #4

The Application of Resource Allocation Analytic Techniques to the Rehab System

February 1983

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D. C. 20510

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Preface

This volume contains papers written for OTA to assist in preparation of the report *Technology and Handicapped People*. OTA does not endorse these papers. In several instances, the OTA report reaches somewhat different conclusions because of additional information which was obtained later. These papers, however, may prove valuable for readers needing more detailed or specific information than could be accommodated in the final assessment report, and are being made available for such purposes.

THE APPLICATION OF RESOURCE ALLOCATION ANALYTIC TECHNIQUES TO THE REHAB SYSTEM

Working Paper #4

FOREWORD

Technology exerts a powerful influence over the lives of everyone, making life easier, more fulfilling, but sometimes more painful and frustrating. This is especially true for people with disabilities. The appropriate application of technologies to diminishing the limitations and extending the capabilities of disabled and handicapped persons is one of the prime social and economic goals of public policy.

The Federal Government is deeply involved in programs that affect the development and use of technologies for disabilities. Congress and other institutions have been increasingly interested in how well programs that directly develop technologies and support their use have been performing. The Senate Committee on Labor and Human Resources requested the Office of Technology Assessment (OTA) to conduct a study of technologies for handicapped individuals. That study examined specific factors that affect the research and development, evaluation, diffusion and marketing, delivery, use, and financing of technologies directly related to disabled people. The problems and processes of the development and use of technologies were analyzed in the context of societal allocation of resources and the setting of goals for public policy. The main report of the study Technology and Handicapped People was released in May 1982.

This case is Working Paper #4 of the study. Working Paper #4 was authored by Mark N. Ozer, Associate Professor of Child Health and Development at the George Washington University School of Medicine. A number of case studies will be published as part of the assessment, and each will be issued seperately. The case studies were commissioned by OTA both to provide information on specific technologies and to gain lessons that could be applied to the broader policy aspects of technology and disabililty.

Each author is responsible for the conclusions of specific case studies. These cases are not statements of official OTA position. OTA does not make recommendations or endorse particular technologies. These papers may prove valuable for readers needing more detailed or specific information than could be accommodated in the final assessment report and are being made available for such purposes.

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THE APPLICATION OF RESOURCE ALLOCATION ANALYTIC TECHNIQUES TO THE REHAB SYSTEM

1. INTRODUCTION

The study on Technology and Handicapped People being conducted by the Office of Technology Assessment has been concerned with the methodologies in use assuring the "appropriateness" of technological decisions. The methodology for assessment of individuals with disabilities has been examined as a technique in its own right which in turn determines the actual plans to be carried out. The methodology for assessment/planning has been found, in many instances, to be ineffective in providing data for proper determination of the training and devices to be prescribed. Particularly noteworthy has been the lack of sophistication in the enlistment of disabled persons in the planning process when approached from the viewpoint of the individual user. Any plan for remediation, including as it does both the outcomes sought and the means for accomplishment of those outcomes, must be appropriate in light of the problems identified and the resources available.

Still another methodology is now being explored as relevant to the making of appropriate decisions both for the individual user and for society as a whole. Crucial to the planning procedure is a technique by which priorities are set in terms of outcomes to be sought and strategies in the form of technologies to be used. This paper deals with the state-of-the-art of methodology for the allocation of resources as a technical problem. The vocational rehabilitation (VR) system is taken as a case-in-point as the largest of the programs in terms of Federal budgetary allocation and Federal influence. The analysis will proceed first with a description of the priorities set by legislative mandate before then describing the technical aspects of allocation techniques at the various levels of systems operation. The third, and final, section of this paper will deal with some suggestions as to criteria to be considered in the design of a resource allocation methodology at the individual level.

2. PRIORITIES SET BY LEGISLATIVE MANDATE

In this first portion of the analysis, the legislative mandate is explored as the reflection of priorities both in terms of population to be served and the range of services to be provided. The analysis will focus on the Rehabilitation Act of 1973 (Public Law 93-112) as amended most recently in 1978 (Public Law 95-602) which remains even now the basis for legislative deliberations in the current Congress. This legislation comprised a major revamping of the Federal-State rehabilitation program.

Population to be Served

The traditional focus of rehabilitation services has been those for whom vocational placement is a realizable goal. This focus has been retained in the basic State programs wherein the definition of eligibility is limited to "any individual who 1) has a physical or mental disability which for such individual constitutes or results in a substantial handicap to employment 2) can reasonably be expected to benefit in terms of employability from vocational rehabilitation services..." (Section 7(7)A).

The basic Federal-State program for the first time included a provision in the characteristics of the State Plans for "continuing statewide studies of the needs of handicapped individuals...with a view toward the relative need for services to significant segments of the population...and the need for expansion of services to those individuals with the most severe handicaps." (Section 101(15)).

Part C of Title I of this Act dealing with the basic Federal-State program included innovation and expansion of the usual services to individuals with the most severe handicaps. This group had been defined as those "with a disability which requires multiple services over an extended period of time." (Section 7(13)). This extension to those who may not ordinarily qualify for rehabilitation service was emphasized in respect to all aspects of this Act including, for example, the charge for research priorities for the National Institute for Rehabilitation Research (Section 204(a)) and support for training of professional staff (Sec. 304(b)).

Even more far-reaching is the commitment under Title VII of this Act to provide comprehensive services for "independent living." Services provided were to be "designed to meet the current and future needs of individuals whose disabilities are so severe that they do not presently have the potential for employment but may benefit from vocational rehabilitation services which will enable them to live and function independently." This new group considered to be eligible for rehabilitation services was further defined as "any individual whose ability...is so limited by the severity of disability [that] ... services appreciably more costly and of appreciably greater duration...are required to improve significantly either his ability to engage in employment or his ability to function independently in his family or community." (Section 702). This same concept was also extended in Part C of this Title to older blind individuals defined as "an individual aged fifty-five or older whose severe visual impairment makes gainful employment extremely difficult to attain but for whom independent living goals are feasible." (Section 721(d)).

Thus a change has occurred in the thrust of rehabilitation services to include those who are more severely disabled for whom vocational goals are not feasible. Although these new directions are embodied in the law, it is noteworthy that budgetary allocations have, to a large degree, reflected the traditional emphasis. The basic Federal-State program for which eligibility includes "a reasonable expectation of employability" was funded in FY 1980 at $817 million; Part C of this same title dealing with the expansion of services to those with most severe handicaps was funded in FY 1980 at $11.7 million. Neither Part A dealing with "comprehensive services for independent living" nor Part C dealing with "older blind" of Title VII were funded in FY 1980 (Summary of Existing Legislation, p. 115-120 passim)

The priorities within the basic Federal-State programs have evolved over the years. The original emphasis on those with physical disabilities, particularly of industrial origin, has come to include an increasingly larger commitment to those with mental disabilities. Starting in 1945, the percentage of "those rehabilitated" with orthopedic disabilities fell from 50 percent to 20 percent in 1972. Those with mental illness including alcoholism and drug addiction rose in the same period from 4 percent to nearly 30 percent. Those with mental retardation rose from less than 1 percent to nearly 12 percent in the same period.

These figures of "those rehabilitated" merely reflect but do not entirely represent the actual allocation of resources to these new groups. The costs of services may be expected to be high for those with mental disabilities and perhaps less likely to result in success and thus being categorized as "rehabilitated." Even more relevant to our analysis, the emphasis on these new groups placed pressure on meeting the traditional vocational goals.

As reflected in the law, there has been an increased commitment to those with mental disabilities; to those with more severe disabilities of whatever category; and to those for whom vocational goals are less likely. This change in priorities in the population to be served has placed an increased burden on the resources available. Moreover, the changes in the types of outcomes that may be sought makes even more problematic the technical aspects of any cost/benefit analysis (CBA) to aid in the allocation of resources. There are major difficulties even in the use of monetary benefits resulting from increased employment of those rehabilitated. Even more difficult is an analysis of benefit wherein the objectives are ordinarily nonmonetary such as improved self-concept or independent life style. Although one may make a partial estimate of the benefits in the rehabilitation of a homemaker and of the impact of an individual's rehabilitation upon the members of his family, there are far too many nonpecuniary factors at work to rely solely upon monetary considerations (Berkowitz and others, 1975 p., 155-58).

Activties to be Supported

The various Titles of the Rehabilitation Act of 1973, as amended in 1978, and their budgetary allocations in FY 1980 are here used to reflect Federal priorities. The major activities considered for analysis are those of the service programs and research, with particular emphasis on applied research as funded by the Rehabilitation Services Administration. It may be noted that considerable applied research is carried out by the Veterans Administration.

Title I of the existing Act describes the basic Federal-State service program and was allocated a total of $828 million in FY 1980. Title II of the existing Act supports the research activities of the National Institute for Handicapped Research (NIHR) with a budgetary allocation of circa $30 million in FY 80. In general, this ratio of circa 3 percent has been maintained for some time (Ibid. p. 30).

The service activities subsumed under Title I of the existing Act may be broadly defined as those related to the assessment/planning process; training and other treatment including the provision of various devices to enhance function; and those which relate directly to the placement and maintenance of clients in employment. The traditional focus of vocational programs on placement and surgical treatment of physical disabilities and basic "hardware" devices has been modified by changes in the population served. The character of the services for those with mental disabilities includes a greater allocation of resources to psychological services and training programs rather than devices. The application of cost-effectiveness analysis, (CEA) to such services presents serious methodological problems (OTA, 1980, Background Paper #3).

A major allocation within the research area under the auspices of the NIHR is the support of circa 20 Research and Training (R&T) Centers generally based in universities. These R&T Centers are concerned in part with the application of engineering developments to the care of disabled persons. Other portions of this overall OTA report deal with the methodological issues of the measurement of effectiveness of their efforts in technological innovation and will not be detailed here. A substantial proportion of the efforts of the R&T Centers is devoted to research in alternative formats for the provision of services to disabled persons. Additional research funding is made available directly from NIHR to agencies concerned with this same area of applied research. Despite the importance of such efforts in light of the quite large expenditures of service funds, the quality of the data generated has generally been inadequate for policy decisions. Particularly problematical has been a lack of long-term followup in such studies and lack of methodological sophistication in research design (Berkowitz and others, 1975, Chapter 14).

A major innovation in the service delivery area is the implementation of Part B of Title VII of the existing Act dealing with "independent living." "Centers for Independent Living" are being established with a budgetary allocation of $15 million in FY 1980. A wide range of rehabilitative services are provided with focus on those services specifically necessary for maintenance of disabled persons in community settings regardless of degree of employability. The character of the setting in which the services are to be provided is also innovative. Disabled persons are to be "substantially involved in the policy development and management" of such centers as well as employed in the provision of services to their peers (Sec. 711(c)(1)).

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Federal funding of services via both Title I of the Rehabilitation Act and the limited funding of Part B of Title VII totalled $843 million in FY 1980. Funding for applied research, particularly in relation to improving service delivery, is only a relatively small portion of the total of $30 million provided for applied research in Title II of the existing Act in FY 1980. Much of the earlier research relating to service delivery has been inadequately designed. Data have not been readily available therefore to aid in decisions as to what would be the most effective service alternatives for any particular client or class of clients. In the absence of such a data base, application of CEA techniques to decisionmaking has been made even more problematic. The application of CBA techniques has earlier been noted to be generally inappropriate in light of the revised nature of the population served and the outcomes sought distinct from traditional measures of income from employment. Thus, changes in the population to be served have made more difficult the use of resource allocation techniques. Continuation of low levels of funding for quality research on service delivery has limited the data available for decisionmaking. The next portion of this analysis deals with the methodology in use in the vocational rehabilitation system in light of these constraints provided by legislative mandates and budgetary allocations.

3. METHODOLOGY FOR RESOURCE ALLOCATION

Title II of the existing Act provided for the establishment of the National Institute for Handicapped Research (NIHR) as part of an effort to "provide for a comprehensive and coordinated approach to ... research, demonstration projects, and related activities for the rehabilitation of handicapped individuals..." (Section 200(1)). As part of its activities, NIHR was mandated to develop a Long Range Plan for research in coordination with a number of other Federal agencies. It is stated in the recently published Long Range Plan that this initial plan was developed with the participation of handicapped persons as well as those who provide services and administrators (Long Range Plan, NIHR, 1981 p. 8-12). It is unfortunate, however, that the methodology by which priorities were established and the actual weight given to the various constituencies' input is not specified. There is nevertheless a stated commitment toward maintaining an ongoing participatory planning activity with internal evaluation of the degree of accomplishment of the Plan and its effectiveness as measured by "changing attitudes, increasing productivity of handicapped individuals [and] improving access to services..." (Ibid, Executive Summary, p. 33).

The planning and coordinating function of the NIHR requires a methodology for establishing priorities and involvement of interested parties. This analysis will therefore focus on the degree such a methodology is available and the extent it is being implemented within the vocational rehabilitation (VR) system. Much of the material upon which this section is based is derived from work done since 1971 by a group at the Texas Institute for Rehabilitation Research (TIRR) and funded by predecessors of the present-day NIHR.

The initial thrust of this work has been the development of a benefit/cost approach toward research fund allocation, which is just now being implemented within the NIHR in part during the present funding cycle. A benefit/cost technique is also just now to be implemented within the newly redesigned Management Information System (MIS) in order to deal with the basic Federal-State service program. Each of these areas of application will be considered in light of the problems, pointed out in the earlier section of this report, that result from the need for nonmonetary as well as economic measures of outcomes for handicapped persons.

Research Resource Allocation

The research resource allocation methodology developed by the TIRR group (Cardus and others, TIRR, 1980), includes several aspects designed to deal with variety in the character of outcomes. There are three general classes of outcomes incorporated in the model. One is that which may be attributed to the individuals, in terms of the target population, for whom the research is primarily directed (B_I). Another is a set of outcomes which might be of indirect benefit given the success of the project (B_S). A third is a set of outcomes of indirect benefit but not related to the success of the project (B_F). Since each of these factors are "net benefits," factors such as B_F would ordinarily include the cost of the research as a "negative benefit" which must be paid regardless of the success of the project.

The overall benefit to be attributed to the project is determined by the following equation:

$$B = P_S \left[(P_U N B_I) + B_S \right] + B_F$$

The factor B_I is thus uniquely affected by the probability of utilization (P_U) in relation to the size of the target population(s) (N). Both factors B_I and B_S are affected by the probability of success (P_S) whereas factor B_F is not so affected.

Both monetary and nonmonetary dimensions are dealt with in this model. Monetary benefits (X_1) may be attributed to each of the three major factors described above. These are described as "all benefits which can be represented in monetary units which accrue to either an individual, a group of individuals, one or more institutions, or society as a whole." (Ibid. p. 3).

Four additional nonmonetary benefits may be uniquely related to factor B_I as follows:

(X_2) Enhanced quality of services exemplified by "improved access to services, improved individualization of services, improved coordination of services, or improved continuity of services."

(X_3) Improved individual client outcomes exemplified by "minimization of functional limitations and personal disability, the encouragement of greater individual social participation, or improved vocational status and material well-being."

(X_4) Improved administrative bases for service provision exemplified by "improved management of information systems yielding timely and relevant administration decision support, identifying operational constraints on operations and implementation, establishing more explicit procedures for program prioritization, and more effective sequencing of program development."

(X_5) Improved policy bases for rehabilitation exemplified by "improved legislative impact and coordination of government entities; the development and communication of policies, plans and procedures; and the facilitation of societal change."

Another nonmonetary outcome cluster (X_6) is uniquely related to factor B_S as an indirect benefit given project success as exemplified by "expanded knowledge bases, the identification of new areas of research and the spinoffs of technology and/or procedures."

A last nonmonetary outcome cluster (X_7) is uniquely related to factor B_F as an indirect benefit regardless of project success exemplified by "an enhanced public awareness of an issue or problem or a sustained effort focused on a research problem."

The identification of these clusters of possible benefits came about through a Delphi-like process involving rehabilitation professionals. Forty-two of the administrative staff of a Federal agency, the Social and Rehabilitation Service, actually participated in listing all benefits which they consider important. A total of 243 potential benefits was thus generated. A cluster analysis reduced the total to 23 personal and 23 nonpersonal benefits. An ultimate clustering brought about the 7 reported above (Ibid. p. 18).

The crucial aspect of this model is the format used to measure nonmonetary benefits and, in turn, integrating those with the figure derived from the monetary benefits. The format for deriving monetary benefits, involving discounting, will not be described in detail. It may be noted again that the monetary benefit is found in all three benefit factors (B_I, B_S, and B_F). In calculating the actual values of the benefits for factors B_I and B_S, a value is determined for probability of success (P_S) by peer judgment based upon suggested criteria such as "(a) the state-of-the-art regarding supporting knowledge; (b) the state-of-the-art regarding technical knowledge; and (c) availability of qualified manpower and resources." A zero to ten scale is used ranging from "impossible" to "certain." Further calculation of the value of B_I requires assigning a value for probability of utilization (P_U) in respect to the various target populations. Criteria have been established and a similar scaling approach is used (Ibid. pp. 58-61).

The quantification of the nonmonetary outcomes ($X_2 - X_7$) is carried out by the peer review process. Given an array of possible projects, each of the projects are initially ranked in the order to which they best fulfill the criteria established for each of the outcomes. That project ranked as the highest is then given a total of 100 points, and the other given a ratio of that figure. The total score of all the projects is then determined and the value for any one of the projects is then normalized to achieve a total of one. As an example, the project which best meets the criteria of outcome measure X_6 (indirect benefits given project success exemplified by expanded knowledge bases, etc.) is initially ranked as #1 and the others appropriately. The project ranked as #1 is then given a value of 100 and all other projects given values in ratio such as 60, 75, 25 etc. The normalized value to #1 may then be 100/260 = .38 where the denominator is the sum of all. In this fashion, a "dimensionless quantity" may be established for all the nonmonetary factors. It may be noted once again that the quantification of the individual nonmonetary benefits to be incorporated into B_I is considerably more complex involving as it does an analysis of the size and other demographic characteristics of the target populations to be served (Ibid. pp. 53-57).

The conversion of these "dimensionless quantities" to a value related to the dollar figure available in the monetary benefit calculation involves several additional steps. Each benefit dimension ($X_1 - X_7$) is assigned a weight which is an estimation of its relative importance as perceived by the responsible decisionmaker(s). A similar procedure for normalization is used as described above so that the total weights add up to one. It is possible therefore for any judge or group of judges to rank the monetary benefits (X_1) as highly important whereas another group might rate some of the nonmonetary benefits (X_2, for example, "enhanced quality of services") much more highly, or any combination of such.

A proportionality coefficient is eventually derived which places each of the outcome dimensions in relation to the dollar figure available in X_1 so that each quantity in the nonmonetary dimension is given a dollar/quantity value. The total benefit value is then derived depending upon the actual quantities in each of the benefit dimensions and the total equation described at the start of this section is then solved (Ibid. pp. 39-41).

A benefit cost ratio is determined to aid in the prioritization of the alternative projects. The benefit figure having been previously derived, the

cost of the first year of the project is used for the denominator to determine the ratio. The decision as to which projects are to be funded is then affected by the funds available drawing from the array of those with the highest cost/benefit ratios (Ibid. pp. 42-43).

A computer program has been designed for use with this model and continued development is going on at this time in the use of the program by administrators so as to apply this model to decisionmaking for project review. The administrator is cautioned to review the quantities being assigned by the computer at various stages so as to assure that the figures being derived do reflect actual experience.

Several crucial assumptions have been made in the design of this model. The model is of course highly dependent upon the quality of the judges as in all systems based upon peer review. One assumption therefore is that such reviewers will be knowledgeable in general. Still another assumption is that data will be available to determine the size and other demographic characteristics of the population to be served. Although estimates may be made based upon existing sources, there remains a need for more adequate information of the incidence of any particular disability.

The most fundamental assumption is that used in the conversion of the quantities based upon subjective values in the nonmonetary benefits category to dollar equivalents. The method does not attempt a direct assignment of dollar amounts to these nonmonetary benefits but establishes a ratio between the dollar amounts and those in the other category. This ratio as to the importance of the various benefits is determined by the judgment of the raters. The maximal value for any one of the benefits as determined for the specific set of alternative projects is also used. By means of this double set of ratios, the computation which permits the integration of the monetary and nonmonetary benefits along a single dimension is specific to the particular set of alternative proposals, the specific people involved in the judgment and the specific time at which the decision is made (Cardus and others, Arch Phys. Med. and Rehab., 1981).

There are practical problems in the application of this model for the actual evaluation of alternative projects within NIHR at the present time. The format developed by the TIRR group presumes a definition of "project concepts" by NIHR staff with proposals elicited to meet specified needs. However, the policy of the new Department of Education in which NIHR was recently placed has a somewhat different set of policies for soliciting research proposals. The peer review procedure presently in place in NIHR emphasizes effective methodology, research design and the background of the potential grantees and not the items more directly related to impact on specific target populations.

Since many of the characteristics considered important in the quality of life consist of physically nonmeasurable values, and as the evaluation of proposed research in rehabilitation must necessarily deal with soft data; this approach attempts to deal with those issues in an unique way as one means of application of cost/benefit analysis (CBA).

Resource Allocation Methodology in Basic Federal/State Program

The application of CBA to rehabilitation services has generally related to monetary measures of benefit. The existing data collection system in vocational rehabilitation has been concerned throughout its history with changes in earnings and other measures which have been traditionally related to vocational status including, more recently, homemaker equivalents of paid earnings. Efforts to apply CBA have gone on for some time starting in the 1960's (Conley, 1965; Abt Assoc., 1974).

This report will focus on one such more recent effort as a relatively complete "social" model carried out in relation to individuals most severely handicapped in light of the legislative mandate to provide services to this population (Dodson and Collignon, BPA, 1975). Emphasis will be on methodological issues in the application of the technique since this model remains the basis for ongoing deliberations over the application of CBA to the rehab system.

In this more complete model, cost estimations included identification not only of program costs but several other parameters. Significant costs were found to be those not directly borne by the rehabilitation agency itself but by other social agencies, and by the client himself. Other rather large factors include circa 25 percent attributed to research, demonstrations, and training costs for counselors. Another major cost to be attributed to the system are those earnings foregone by those involved in rehabilitation. For example, the average period of rehabilitation was 15 months in FY 1980 and the number foregoing earnings was calculated at 15 percent of those rehabilitated (Ibid. pp. 4-8).

Paid earnings are the traditional major benefit identified. There remain major issues concerning the gain to be attributed to the rehabilitation program. Comparisons are generally made between earnings in the week prior to acceptance in the program and the earnings of those rehabilitated at the time of "closure" (status 26). It may be noted that entry into this status is defined by the existence of earnings for at least 30 days prior to closure. Considerable variation can come about by alternative time intervals from which to calculate base earnings on entry. It is, for example, suggested in this study that earnings during the previous quarter year be used rather than at the time of acceptance since the latter figure tends to underestimate earnings.

The actual value of the earnings at closure must be further analyzed. Modifications must be made because of the age of the individual in terms of retirement and mortality projections. Other factors considered include possible decay in the number employed due to worsening of the disability or changes in the family situation; changes in wages paid overall due to productivity in the economy and changes in productivity in the employed person as a result of time in this person's career cycle. The younger person or the person entering a new profession may show sharp increases in earnings due to mastering his new job. Over the lifetime of the individual, earnings tend to increase rapidly before reaching a peak which is maintained until a slight decline at the time of retirement. Another major decision affecting earnings valuation is the discount rate to be used for dollars being spent now in light of opportunity costs and the general interest rate for investment to be used.

Additional possible benefits identified in this more complete model include homemaking and unpaid work as well as paid earnings. Adjustments must be similarly made for mortality, retirement, productivity, and discount rate. Unpaid earnings vary with the sex of the individual with women employed full-time devoting almost two-thirds as much time to homemaking as do full-time homemakers. For men, this figure is circa 20 percent. Thus, the unpaid work factor must be weighted differently. The assumption is that homemaking and unpaid work can be valued at the same rate in this study. It may be noted parenthetically that closure earnings for homemaking may approach paid earnings in many instances in light of the frequent placement of disabled workers in settings paying the minimum wage.

Additional benefits to be measured are fringe benefits paid. Modification of the usual calculation for fringe benefits is made for the character of employment opportunities for disabled persons. They are relatively frequently involved in industries where fringe benefits tend to be low. Their work history also tends to be discontinuous. Hence, the normal figure of 19.6 percent is halved in this study.

The last major benefit is that of changes in family labor force participation as a result of rehabilitation. Allowance must be made for those family members who are able to find paid employment because they have been released from caring for the disabled family member due to his increased capacity for self-care and homemaking. This adjustment factor is, however, modified by family members finding they no longer need to work or need to work two jobs because of the entry of the rehabilitated person into the labor market. In the study being reviewed, benefits were calculated as 8 percent of the average annual increase in direct employment earnings from acceptance to closure, modified by entries by other members of the family into the labor force as a normal effect (as young people have grown in age) unrelated to rehabilitation of other family members (Ibid. pp. 9-17 passim).

Three different formats for the presentation of the data were developed in this study. The most basic cost/benefit ratio is one which consists only of paid earnings to program costs excluding fringe benefits and homemaking leading to higher returns than the more complete social model. In the latter, the cost benefit ratio displayed less return by the addition of the additional costs such as overhead and other costs identified above and overcame the inclusion of social benefits additional to paid earnings. The third format for presentation is that of discounted net present value. The difference between costs and benefits is expressed in dollars. For example, with a discount rate of 13 percent in 1972, the overall rehabilitation program provided a basic C/B ratio of 10; a social model a C/B ratio of 8; and a net return, using the entire social model, of $7,730 million.

The basic mathematical formulation containing the factors described as well as others is as follows:

COSTS:

$$DC = R - DRC - DRM + DRP + RRT + OF + CBC$$

DC = Incremental costs of program

R = Program costs

DRC = Carry over costs

DRM = Maintenance costs

DRP = Costs borne by parties other than Rehabilitation agency

RRT = Research, training and demonstration costs

OF = Output foregone during rehabilitation process

CBC = Client borne costs

BENEFITS:

DB = DER + VHMKT + VUPW + VFB + DOF - DRR - CAUS

DB = Total benefits attributable to program

DER = Total discounted present value of the increase in earnings ascribable to program

VHMKT = Average annual value of a full-time nondisabled homemaker

VUPW = Change in output of unpaid work

VFB = Change in output of fringe benefits

DOF = Change in output of families

DRR = Repeater costs

CAUS = Reduction in benefits attributable to VR

The crucial benefit of "paid earnings" (DER) is further derived as follows:

$$DER = \sum_{L=1}^{10} DERV_L$$

$$\text{where } DERV_L = \sum_{i=1}^{10-L+1} ERNAGE_{L,i} \times YRSLIFA_{L,i} \times DIS_L \quad L = 1,\ldots,10$$

where $DERV_L$ = Discounted present value of the increase in earnings ascribable to program, in the Lth period.

$ERNAGE_{L,i}$ = Average increase in earnings, ascribable to program, in the Lth period for the i-th initial age group.

$YRSLIFA_{L,i}$ = Man-years of life surviving "26" closures below age 65 in the period for the i-th initial age group.

DIS_L = Discounting factor in the Lth period.

L = subscript for 5 periods into the future (years after acceptance by 5 year time periods), for example, L=1 means years 1-5; L=10 means years 46-50.

Incidental to the methodological issues being emphasized here but relevant to the overall issue of rehabilitation are the actual data as to benefits gained by those most severely handicapped through their inclusion in the system as mandated by law. In FY 1972, the basic C/B ratio at a discount rate of 13 percent for this group was 7.0; the social model C/B ratio was 5.9; and the return using the discounted net present value was $1,760 million. The differences in results between the total population of those rehabilitated and those with most severe handicaps were due to more stringent mortality assumptions, greater average case services costs, and the older age of this group thereby reducing the length of time benefits might accrue.

Several important issues remain in understanding the use of this model and the actual data that were derived. Although the discount rate used in 1972 was considered to be quite conservative at 13 percent, the present discount rate for investment in 1981 is considerably higher with significant implication for possible net return. The limitation to status 26-type closures tends to obscure any benefits achieved by those who received rehabilitation services but did not reach the status of "rehabilitated." None of those dropping out over time from the paid earnings category have had their homemaking or unpaid work valued. Savings in medical, nursing, housekeeping, and child care expenses due to the ability of those rehabilitated or those who had needed family to take care of themselves and their household's needs are not included. Savings to taxpayers, particularly in terms of potential need for institutionalization, are not included. This is particularly applicable to the mentally retarded, mentally ill and those placed in prison. Data are lacking as to long-term retention of employment specific to the most severely handicapped.

Most problematical is the basis upon which an individual is categorized as "most severely handicapped." The inadequacy of the basis in use is clearly stated in the body of the study being reviewed. Categorization in terms of membership in specific medical classes has been used. The intent of Congress in extending services is perhaps not met by an individual's inclusion in a medically based category of severity. Rather the intent was to extend services to those that take the longest and/or cost the most to rehabilitate. The intent may also be to consider those who are least successful in the rehabilitative process, either in being successful closures or in being accepted for services at all. Although the data developed in the study being reviewed seemed to support a favorable return in this group for money invested, lower results do not indicate that services to the most severely handicapped should be diminished. Given the legislative mandate, these services should be provided. The value of the methodology remains in clarifying the existence of lower cost benefits accruing. It may then lead to the development of new strategies for the provision of services or even new services in order to increase benefits relative to costs.

Several of the data limitations to adequate CBA of the basic State/Federal service program have been addressed in the design of a new management information system (MIS) now about to enter into its pilot phase. Data are to be collected concerning the more functional aspects of the client rather than

the traditional medical diagnostic categories. In meeting the legislative mandate of inclusion of the more severely handicapped for whom vocational goals are not necessarily sought, data are to be collected as to status other than the traditional case closure in paid employment. One particular emphasis of the independent living movement has been to consider the process of rehabilitation as a goal in itself in terms of client responsibility and involvement. All these developments have made the measure of nonmonetary benefits even more germane to the methodology of cost/benefit analysis in rehabilitation (Plourde and others, Abt, 1981).

The contemplated MIS has been in the process of development for some time and its design has been perforce heavily influenced by the incremental nature of any changes in a large-scale, long-established service program. The integration of a cost/benefit analysis capability utilizing both the BPA model as above and the TIRR model originally developed for research resource allocation is going on at this very moment (Cardus, TIRR, 3/81; Cardus, TIRR, 7/81).

The first stage of the integration effort was the identification of qualitative benefits by the TIRR group. A Delphi-like survey was conducted with 109 individuals. The group was widely representative of the users of any MIS and participants in the delivery of services at Federal and State levels. Federal officials at the national and regional offices were joined by State level administrators. In addition, a wide range of provider groups were involved as well as consumers. However, it is not clear as to the actual representation from these various segments of the rehabilitation community and the weights given to their contributions.

Twenty-one benefit factors were eventually defined. These have been further prioritized by being partitioned into those of low, medium, and high importance and correlated with the data being sought in the planned MIS. The benefit factors considered as "highly important" that are also found to be relatively well measured by the planned system include:

Improved physical, psychological, and interpersonal functioning by handicapped persons,

Improved quality of rehabilitation services,

More cost-effective rehabilitation services,

Reduced need of handicapped persons for public support and improved capacity for them to pay taxes,

Greater participation of handicapped persons in the work force,

Improved vocational and economic status of handicapped persons.

Two other factors considered of high importance not well measured by the proposed MIS or only partially measured include:

Better coordination among agencies serving the handicapped,

Decreased environmental barriers and improved access to recreational and educational opportunities for handicapped persons.

The partitioning step is crucial if the weights assigned would appear to exclude consideration of a number of benefits of "medium importance" which are not measured by the contemplated MIS:

More positive attitudes by the public toward handicapped persons,

Greater social participation by handicapped persons,

More knowledgeable and actively involved consumers of rehabilitative services,

Better Federal policies for rehabilitation.

Of "medium importance" according to this partitioning and only partially measured are:

Promotion of independent living for handicapped persons,

Better trained and more effective service providers.

A number of qualitative benefits have thus been derived of both "high" and "medium" importance. Some are potentially measurable by the planned MIS while others are not so easily done. Several are translated into possible monetary benefits while others are less tangible. Some are less specific to the character of the basic service program.

In further development of a model for quantifying benefits, a set of five benefits has been proposed to be directly relevant to the service program. In a three-dimensional model, the following benefit classes are to be measured analogous to that used by the TIRR group for research resource allocation decisions.

B_1 Monetary dimension including "reduced need of handicapped persons for public support and improved capacity for them to pay taxes, greater participation in the work force, improved vocational and economic status of handicapped clients." This dimension will also include monetary components of "improved physical, psychological and interpersonal functioning by handicapped persons [and] promotion of independent living by handicapped persons."

B_2 Nonmonetary consequences of "improved physical, psychological and interpersonal functioning by handicapped persons."

B_3 Nonmonetary features of "independent living for handicapped persons."

This set of dimensions is being considered at this very moment in terms of their measurability within the MIS by the various groups working on this integration of cost/benefit analysis approaches. It may be noted that the selection of the nonmonetary benefit factors have been derived from the universe of the 21 benefit factors including the principle of "independent living" although it is not well measured within the contemplated MIS. There are some doubts whether the component of dimension B_2 is well measured by the contemplated system. There has also been some criticism about the relevance of

the "taxpayer" type benefits being addressed in benefit dimension B_1 to the type of data available in the Berkeley Planning Association (BPA) model of monetary benefit measurement.

In addition to the difficulties in measurement of the contemplated model, the issues of valuation of the nonmonetary benefits remain as in the research allocation model previously developed by the TIRR group. It has been proposed that the valuation step be carried out in a fashion analogous to that described elsewhere in this report. Namely, relative importance estimates are to be derived for each of the three benefit dimensions by a set of judges, normalized, and then used to relate the values of the nonmonetary dimensions to the value established for the monetary dimension. An interactive computer program is to be designed for the calculations necessary and a "dollar net measure of all benefits and costs" will be derived.

The presentation of the actual cost/benefit ratio has been proposed by the TIRR group as follows: $r=V/C$, where V is the "dollar net measure" and C is the expenditure for which the manager is directly responsible. The character of the denominator is similar to that used in the research allocation model in that it reflects only the cost for which the decisionmaker is directly responsible for at the moment of decision. This aspect has been criticized as inappropriate in that it obscures the actual costs incurred by the system as a whole and encourages narrow bureaucratic budgetary decisions. For example, if this model is applied by the State level, the denominator as proposed might only include 20 percent State share of service costs omitting the 80 percent Federal contribution.

It is important to recognize the tentative nature of the proposals now being considered. These ongoing efforts have been described in this report in detail only to indicate some of the methodological difficulties inherent in the state-of-the-art of techniques for resource allocation decisions in rehabilitation service programs. Problems remain in the search for adequate methods for measurement of nonmonetary as well as monetary benefits. The data sources projected in the MIS had been previously determined on the basis of the state-of-the-art of assessment techniques and provide only limited support for the cost/benefit analysis now being introduced. Any increased burden to a service program for data for evaluation purposes must be justified. Problems also remain in the valuation step and the relationship between the nonmonetary benefits and the dollar figure developed for monetary benefits. The attempts by the TIRR group to deal with this issue in an innovative way must still be generally accepted. It does suggest that an alternative may be possible to the constraints inherent in economic analysis.

Resource Allocation in State Programs and Effectiveness of Specific Services

Thus far, this report has dealt with the state-of-the-art of resource allocation methods both in research and the overall Federal/State program in attempts to solve the problems offered by the existence of both monetary and nonmonetary benefits. Another basic constraint to the implementation of this methodology has been the absence of adequate data as to the effectiveness of alternative services. The models described thus far do not deal with the effectiveness of specific services in relation to specific individuals. Yet these are the allocation decisions that may be of potential value in direct service programs. This portion of the report relies heavily on attempts to

focus directly on the relationship between services and client outcomes in the States of Michigan and Washington as part of an overall study mandated by Congress on the provision of services to "individuals most severely handicapped." (Dodson and others, BPA, 1975). Focus will be on the methodology used rather than the data generated relating to those who fall within that category and "others." As pointed out earlier, the definition of those most severely handicapped has been based upon membership in specific medical categories and does not necessarily reflect the severity of functional disability. Nevertheless, the methodology used still remains an exemplar.

The possible use of cost/effectiveness methodology is available only within State programs and even then only to a limited degree. The overall Federal/State information system does not permit such an analysis since the Federal reporting form R-300 only notes the receipt of few of the possible services. Agency financial records which served as the basis for this study includes information only on those services directly purchased. Agencies apparently do not monitor how much time is spent by counselors in general with individual clients nor how much time is spent with individual clients performing various kinds of services. Yet the highly personal relationship between the counsellor and client may be as important in the rehabilitation process as the services provided. Indeed, focus on the rehabilitation process itself is one of the basic concerns of the independent living critique of rehabilitation services (vide supra, p. 9).

This study envisaged the rehabilitation process as a "production" process. Improvements in the client's vocational situation are "produced" by combinations of factor inputs. The attempt was to estimate "production functions." If rehabilitation (entry into status 26 or change in paid earnings) is the product, the process may involve the application of a number of "production functions" varying with the different kinds of clients with differing needs. Thus, personal and disability characteristics may affect the rehabilitation produced along with the services provided.

The production functions are mathematical relationships describing the ideal relationships between sets of inputs and sets of feasible outcomes. These functions can tell what are the possible different outcomes that any given set of resources (or factors of production) can produce given the factors are used efficiently. If the agency has a fixed set of resources, knowledge of its production functions will enable the manager to select, from the alternatives available, the set which maximizes the program's stated goals. Conversely, if a specific set of outcomes is postulated, the production functions will describe the ways in which different factors can be combined to achieve the stated result. By knowing the price of these factors, the production function can be converted into a cost function which can be used to select the least costly of the alternative means of achieving the agency's goal.

The production function describes the effect on output of changing factor quantities, the effect on other factor requirements of changing the quantity of any one input while keeping others constant, and the effect on factor requirements of changing the level or mix of outputs. The production function, however, remains fixed so long as the underlying technology being used remains unchanged and the efficiency with which the agency operates remains at a maximum.

The efficiency assumption is made in the classical application of this model by economists to ordinary production by private firms because the market place is assumed to remove an inefficient producer. No such test can be applied to the public sector. No basis exists for assuming that the data drawn from the public service sector represents the most efficient use of resources. It is therefore uncertain whether the cause of the differences in effectiveness between services is due to the technological character of the services or to the efficiency of the service delivery.

Given these caveats as to the data base and the application of the production model to the public service sector, this study identified the following possible factors affecting outcome:

Services received (the amount of expenditure serving as a proxy for the amount of services),

Various demographic and disability characteristics which should affect the services needed,

Overall impediments to employment confronted by the individual.

The mathematical representation of these factors is as follows:

$$o_i = f(s_i, d_i, c_i, e_i, u_i) \quad i = 1, \ldots, n.$$

Where:

O is the output measure; it describes the change in the degree of success between time of referral and closure.

S is a vector of selected vocational rehabilitation services and S_i describes the amount of different services received by person i.

D is the vector identifying disability type.

C is a vector identifying relevant client characteristics (those which affect the client's expected success at closure and the type of services he receives.

E is the vector describing relevant environmental characteristics.

U is the error term accounting for the compound effect of all other variables not included in the model.

By defining a person's change in earnings as an output measure, the relationship between the type and mix of services and the outcome can be described. However, such an analysis would not help the policymaker prescribe more effective individual programs. If, for example, descriptive statistics indicate that clients who receive academic training do better than those who receive on-the-job training, no inference as to differences due to service effectiveness can be made. The difference in earnings obviously relates to the differences in type of client each of the services attracts. Because personal and environmental characteristics also influence the degree of success a client experiences, the statistical approach adopted attempted to distinguish between

the marginal effects properly attributable to the service and those due to other factors. Regression analysis was therefore used as the statistical method in this study (Ibid., p. 168).

The major measure of outcome used in this study was change in earnings between referral and closure. This quantity is an accurate representation of outcome only if the earnings at referral are a correct indication of the client's initial ability. Problems arise for students or homemakers where zero earnings at referral are clearly not an indication of their ability. It is also not a good measure for the skilled client who has just become unemployed and receives a modicum of services particularly those helping him or her find work with great effect. Earnings at closure was therefore used as an additional outcome measure.

Since the quantity of earnings is highly dependent upon the client's personal characteristics, still another outcome measure was used. The existence of a successful closure (status 26) was quantified in terms of its probability with the assumption that all clients aimed at successful closure. This additional measure reflects the counsellor's general definition of success in terms of a particular client's realistic capabilities and thus controls for some of the individualistic characteristics of each client (Ibid., pp. 173-175).

The identification and quantification of the service variables were limited in this study by the data base available. The measure of the quantity and quality of a service provided to a client was here taken to be its total cost. Interpretation depends on the assumption that the price of a service reflects its quality. General service categories included:

Diagnosis and evaluation

Restoration

Training and education

Employment aids

Diagnostic services were assumed to have indirect effects on outcomes in that they helped the counsellor prescribe effective services. Restoration services such as medical treatment and prosthetics were assumed to have both indirect consequences on the effectiveness of other services as well as direct effects on outcome. Education and training services were directly related to outcome by increasing the skills and ability of the client. Employment aids such as job placement and transportation were assumed to affect the amount a person might be able to earn and would also affect the contribution provided by education and training.

The personal characteristics of the client included type of disability. However, disaggregation into type of disability was not possible in this study since there were insufficient cases to carry out separate regressions for the different disability groups. Other client characteristics included educational level in terms of discrete events such as completion of high school. Client "drive" was measured by age as a reflection of greater socialization into the work force, by the number of dependents providing an obligation to work, and by the number of other wage earners in the family. Women, particularly those who

were married, may feel less need to seek paying jobs as well as encountering job discrimination. Thus sex as well as marital status become relevant measures. Racial minorities similarly confront discrimination affecting employability and earnings. Sex and racial factors were thus considered not only measures relating to "drive," but as exogenous environmental conditions which make successful rehabilitation more difficult to achieve.

Client "adaptability" was also considered to be a possibly relevant characteristic but proxy measures for this were more difficult to find. Employment status at referral and income at referral were used but were not felt to be satisfactory. Nor was educational level satisfactory as a measure of aptitude and intelligence.

Environmental variables were considered to be potentially important including such factors as the state of the economy. However, the costs of carrying out such an analysis were considered prohibitive in respect to each of the locales in which an individual was living. In a previous study, the authors had found that unemployment rates did not yield statistically significant parameters and were omitted from this study (Ibid., pp. 176-182).

This model permits the presentation of data in a number of different ways. It may be recalled that outcomes are measured in terms of the probability of success (status 26 closure), change in earnings between referral and closure, and earnings at closure. Separate analyses were therefore done as to success rate by client characterisitics, by "major service" category, by service mix, by change in earnings on the basis of service quantity, and in terms of the two major population groups of "individuals most severely handicapped" (IMSH), and non-IMSH. While recognizing the problematic nature of the criteria for the IMSH category, in light of the Congressional mandate to serve this population, this report will focus on the data generated for IMSH alone. In general, the success rate for status 26 closure is somewhat higher for this group attributed to its greater age and educational level while the costs of services are somewhat higher. The findings in this study thus tend to confirm the lower cost/benefit ratio for the IMSH described elsewhere in this report in relation to the national program. For the purposes of this report on illustrating methodology, the probability of success rate defined by status 26 closure will provide the focus for review.

When the analysis is of the "major service" expenditure category, it was found that all those IMSH clients receiving diagnosis and evaluation (D&E) as their major service have the least chance of successful closure. The figures are 37 percent in the Michigan sample and 44 percent of the Washington sample. Conversely, those receiving prosthetics as their major service (a component of restoration services) had 82 percent success rate in Michigan as the highest correlation. The highest correlation in Washington, 76 percent, was for academic training in a college or university (a component of training services).

It is postulated in this study that when D&E are the major service expenditure, it is likely that this service is used to screen out those for whom additional, potentially even more major, expenditures are not to be prescribed. However, it is rather surprising that such a high percentage do have successful closure with D&E alone. It may be noted that counselling is likely to be provided along with the D&E stage but is not identifiable as a service category in this study in the absence of cost figures.

When the analysis extends to the one-half of clients with a service mix, it was generally found that success rate increases with the addition of several services. When D&E is the "secondary" service (in terms of costs), the success rate is occasionally maximized. For example, when prosthetics was the major service and D&E the secondary one, the success rate correlation reached 90 percent in Michigan as compared to the 82 percent figure quoted above. This would tend to support the contribution of substantial D&E expenditures as aiding in the effective, further, major expenditure of prostheses so prescribed. Major expenditure for restoration services such as surgery and hospitalization was also enhanced in the Washington data by secondary investment in D&E services.

Conversely, substantial secondary investment in D&E services seemed to detract from success correlation for major expenditure in "formal training" (distinguished from academic or on-the-job training) in the Michigan sample. In Washington, D&E as the secondary investment detracted from correlation with success for those whose primary investment was in academic training.

These results are merely suggestive rather than conclusive in the light of the frequently small numbers in the various cells. The entire concept of "major service" is of course problematic since cost alone is used to establish the importance of the service. However, it is highly relevant to consider the contribution of D&E services to the proper selection of service expenditures since such determinations are an ultimate rationale of the D&E effort.

When client characteristics, including demcgraphic ones, are introduced via a regression analysis, these service mix interactions all failed to reach significance (at 5 percent level) in establishing the probability of successful closure. It therefore appears, as in several of the other analyses carried out, that the services ordinarily provided by the rehabilitation program do not overcome the basic characteristics detracting or enhancing a client's probability of success.

Still another analysis might be more relevant to answering the basic question as to whether the amount of services using existing technology have differential effects on the probability of success. In many cases, counsellors do not have a choice in the selection of services. The nature of a client's disability may preclude (or appear to preclude) him or her from receiving some services. The counsellor's only choices may be to offer a larger or lesser amount of what appears to be the required service. The average cost per client by service category is calculated whether successful or not.

For Michigan, the pattern of resource distribution for successful and unsuccessful IMSH differs. For those who are unsuccessful, the most resources are used in D&E and "other formal training." For those who are successful, other formal training, academic training, and then D&E receive the most resources. In Washington, the pattern also differs between the two categories. For the unsuccessful, the most resources are used in surgery and hospital treatment. For the successful, academic training and other formal training receive the most resources. Thus, for both states a successful closure is related to the provision of training, particularly academic training in a college or university.

Further analysis of these patterns gives a statistic derived by dividing the average cost of a major service by the success rate. This statistic

describes the amount of money a counsellor expects to spend on a service in order to gain one successful closure. The average expected cost of a 26 closure of a major service is thus an indicator of the service's cost-effectiveness since both cost and success rate have been introduced.

For Michigan, vocational and personal adjustment services (a component of employment aids) were the most effective major service provided. That is to say; if the major expenditures are in this area, there is the greatest likelihood of the dollars leading to success. This, of course, presupposes that the client's characteristics permit the selection of these services to be the major thrust of the client's program. These services are actually not offered very often as the major expenditure. The least cost-effective services in Michigan are those higher cost items such as other formal training, academic training and surgery and hospital treatment. For Washington State, sheltered workshop placement (also a relatively uncommon major service) and D&E are most cost-effective. Surgery and hospital services and maintenance payments were found to be the least cost-effective.

Given the much higher surgery and hospital costs of the unsuccessful IMSH, it is stated in this study that one may assume that this group of unsuccessful closure is indeed quite severely disabled. However, when one compares those who are eventually successful with those who are not successful, one finds that they both receive similar levels of overall expenditure on major services. Therefore it appears that once diagnosed, the IMSH as a whole receive the full slate of services regardless of how they seem to be progressing during the period they are in the VR system. Thus the cost of IMSH services overall is higher by virtue of the cost of eventually ineffective services (in the nonsuccessful) being as high as for those eventually successful.

A further question addressed is whether or not there is a relationship between success rate and the distribution of clients and of agency resources across service categories. If the aim is to increase the cost-effectiveness of resources expended one would expect to find a positive correlation between success rate and the distribution of clients and resources across service categories. If counsellors consider cost effectiveness when screening or allocating services, one would expect to find the largest proportion of clients in the service category which offers the best success rate. For both Michigan and Washington, the correlation between major service frequency and success rate does not meet the significance level established at 5 percent.

One conclusion drawn by the authors of this study arises out of the two types of analyses described above. The first finding was that there were not differences in the level of overall expenditure on major services for both the successful and nonsuccessful. The second finding was that, when client demographic characteristics were controlled, the relationship between service expenditures and successful outcomes becomes positive for all services (with the exception of D&E). This relationship suggests that effective services should vary in amount and type among IMSH of different characteristics and thus should be reflected by more variation in the amount of services delivered.

Two quite different scenerios may arise out of these findings with considerable implication for decisionmaking on the part of the counsellor to enhance cost-effectiveness of services. The first may state that clients who are offered more services do better than other clients because they receive more

services. The policy-relevant conclusions would list the services with the largest likelihood of success and suggest that expenditure on these services be increased in order to maximize probability of successful closure. The other suggested in this study would be to concentrate on what is called a "screening policy." The services with the greatest coefficients of success are generally those which are of higher cost from which the clients may be screened out before these higher costs are incurred. It is suggested, therefore, that the counsellor should increase his own ability to detect the potentially unsuccessful clients before offering them these costly services. It is not stated, but presumably such an approach would require a greater degree of carrying out the rehabilitation plan in stages cognizant of the cost parameters (Ibid., p. 114).

The major conclusions of this study tend to focus on the D&E process as the site for improvements in cost-effectiveness for the IMSH group. It is suggested that better prescription of services sensitive to the characteristics of the IMSH would be reflected by more variation in the amount of services provided. This could be accomplished by the screening mechanism whereby presumably ongoing evaluation and planning can reduce the number of clients who are futilely given additional services. It is therefore recommended that yet additional investment be made in the already high commitment to D&E services. The likelihood of such expenditures leading to better prescription of services must be tempered by the state-of-the-art of the technology of assessment/planning as reviewed in another portion of this overall report on Technology and Handicapped People.

Although the focus of this report has been on the use of successful closure as the outcome measure, still other analyses carried out in this study point to quite different results when earnings are used. Some services were negatively associated with change in earnings when client characteristics were controlled. Yet such services were positively correlated with the probability of employment closure. It appeared to the authors of this study that rehabilitation counsellors in serving IMSH focus primarily on getting clients employed rather than in providing them with skills which might make them economically self-sufficient or at least experience higher earnings. The cost-effectiveness of service expenditures in terms of earnings generated do not appear to be very high, once basic employment was achieved. D&E again appeared to be useful in achieving service prescriptions and investments more in keeping with the client's earning prospects.

The general methodological limitations of carrying out cost-effectiveness studies of ongoing human service programs are well documented (OTA Report on Implications of CEA to Medical Technology, 1980). The limitations of such a methodology to the rehabilitation system add to those noted for medical technology. Most noteworthy is the relative lack of data regarding the efficacy of services -- a result of the generally low level of research on service delivery in this field (Berkowitz and others, 1975). The limitations of this specific study have been alluded to throughout this review. These include the assumption of maximum efficiency required in the application of the "production" model to human services in the public sector. The unavailability of adequate cost figures for the counselling process itself has led to the omission of what is likely to be a highly significant portion of the services actually provided. The lack of specificity of the concept of "major service" inherent in the use of cost figures only is a severe limitation. There remains as well the ongoing issue emphasized in other parts of this report of the limitations when

outcomes sought are limited to closure, let alone earnings, and not an even wider range of outcomes.

4. FUTURE DIRECTIONS

The existing state-of-the-art of resource allocation methodology within the vocational rehabilitation system has been reviewed. The methodology is in the process of development at this very time. The legislative mandates for better coordination in planning research allocations, for increased emphasis on services to the most severely handicapped and those for whom employment goals are less likely, have pointed out the need for better sources of data for analysis. The existing methodology, however limited, has demonstrated the value of CBA/CEA in defining the issue of higher costs for such newly added groups as well as some possible remedies.

In meeting the legislative mandate in the presence of increasing budgetary stringency, it has become even more necessary for the development of a resource allocation methodology that can be brought to bear directly at the level of the individual counsellor and client. One specific site for remediation already suggested has been in the diagnosis and evaluation process. These procedures must lead to better prescription of those services actually needed; the selection of a mix of lower cost services which might bring about some initial results, and the staging of services in terms of cost. The remainder of this report will deal with some of the characteristics of the application of a resource allocation procedure at the level of the individual plan. Such procedures must be responsive to the variety of personal and demographic characteristics of clients as well as the ultimate need for data for use in policy determinations at program levels.

The format for this section will be to consider first the outcomes sought within the rehabilitation system and then some of the more technical aspects.

Outcomes to be Sought

The outcomes defined by legislative mandate over the years has been based on the notion of "productivity." Such a measure has recently been expanded beyond earnings in employment to recognize the contributions to productivity made by homemakers and to the community by unpaid volunteers. This continuum, however expanded, still remains the basic measure of outcome and all efforts must somehow be related to it as required by law.

Still another outcome is the degree to which the individual is able to function in the "least restrictive" environment. Like the principle of productivity, this outcome relates to a continuum of independence and degree of support by others with implications for resultant costs. The set of possible outcomes has recently been expanded far beyond the support available in institutions. The so-called deinstitutionalization movement has sought, with some public support of community based services, to increase the likelihood of disabled persons living independently in their own homes. As pointed out elsewhere, both the expansion of the principle of productivity to other than gainful employment and the expansion of the range of options for support for living independently are relatively new concepts expressed in the most recent law.

Underlying these new concepts has been another outcome widely sought by disabled persons themselves. The measure of "self-determination" is the degree of control taken by the individual vis-a-vis the professional and institutions

in general. This goal is expressed in public policy in the requirement for client participation in the creation of the individualized rehabilitation plan.

It is important to recognize that these goals are mutually supportive and must be considered as an entirety for any disabled person or population. Self-determination is enhancing of living independently and of productivity. Independent living should not be seen as an alternative to gainful employment or other measures of productivity.

Some rather fundamental revisions in the concept of rehabilitation are necessary in order to meet these goals at the level of the individual client. One assumption rather pervasive in the rehabilitation system has been that of time-limited services. It is interesting to note in this connection that rehabilitation programs have traditionally been sited within State Departments of Education. This connection has been recently confirmed within the Federal level as well. The thinking within education, until quite recently, has been to consider the educational process to be bound by a course of study ending in a relatively fixed time frame after which the student enters the work force. The principle of continuing education going on over the lifetime of the person is relatively new. The principle of closure of a rehabilitation case has continued to be one of the major goals of the rehabilitation system.

The rehabilitation of those with mental and other disabilities less precise than those remedied by the provision of a specific prosthesis has already led to the lengthening of the rehabilitation process. In FY 1970, the duration was circa 15 months; more recently it has been estimated at circa 24 months. If rehabilitation does indeed extend over increasing time, it might be necessary to reconsider the implications of closure as an outcome. Just as educational goals have been revised so as to enable the student to have the tools for ongoing learning, so rehabilitation goals might emphasize a client's ongoing skills to a greater degree. One such tool is the client's capabilities to develop adaptive strategies to deal with his or her functional disabilities in interaction with changing requirements of jobs and life situations. One specific skill therefore would be the capability to plan for his own needs and to manage his own resources. Thus, the outcomes sought within the rehabilitation process might be more long range and also more focused on the process itself.

The management skills necessary for "production" in this model are somewhat different from those in the production of a job placement and closure. What may be required is the use of a management system appropriate for the development of new technology and ideas; the management of an R&D firm rather than an auto factory. The principle is that of resource development in the way of resourcefulness. A requisite skill in counsellors is the ability to generate such resourcefulness in clients, or more frequently, to enhance any resourcefulness already present. Such an approach is highly compatible with the professional goals of the rehabilitation counsellor. However, its actual implementation requires much more meticulous attention to that goal via participation of disabled persons to a much greater degree within the rehabilitation process itself. This thrust is one of the tenets of the independent living movement. The recent funding of programs under Title VII of the existing Act provides an opportunity for assessing the cost-effectiveness of services being provided in this more participatory mode.

At the level of the individual counsellor and client, regardless of site, there is need for integration within the established planning procedure of simple techniques for resource allocation decisions along with the client's participation in such decisions. It would be the responsibility of the counsellor to be familiar with the array of possible services, with the probabilities that certain activities will lead to specified results, and for eventually transferring the technology of rational planning itself.

Techniques for Resource Allocation

The techniques described for the peer review process in the Texas Institute for Rehabilitation Research (TIRR) model for research allocation decisions may serve as an example. They are not in themselves very complex in principle. Their application to the individual counsellor-client interaction would require relatively little modification. As described elsewhere in this report, possible goals are generated in all relevant dimensions, including both monetary and nonmonetary. These goals can be specified in terms of measurable behavioral outcomes. Their valuation can be carried out by a number of simple well-established weighting procedures including, but not limited to, the "magnitude estimation" technique used in the TIRR model. One additional measure required is the degree of participation by the client and one may separately assess this continuum in each of the steps used. One scale available is a measure of the verbal behavior of the client vis-a-vis the counsellor. Others can no doubt be devised.

Given a set of agreed upon outcomes with assigned priorities, the decisions as to the means for accomplishing these outcomes could follow a similar format. Once a number of alternative means are generated, and perhaps clustered; the probability of their meeting the stated outcomes can be assigned weights in terms of judgments as to which activity would be most likely and then second and so forth; and then normalized. In this way, a measure of possible effectiveness is generated. Those considered the most effective in achieving the highest priority goals can then be assigned costs. Such cost data would presumably be provided by the counsellor; but in many cases, might be the responsibility of the client. Cost-effectiveness ratios would then be generated. The final decision as to the allocation of the resources available could then follow any number of well-established techniques.

At specified intervals, the actual effectiveness of any array of services in meeting the goals may be jointly evaluated and numerical quantities assigned if necessary. The procedure is then recycled. If one of the major goals of the rehabilitation process has been to increase the participation of the disabled person in decisionmaking, it would be necessary for a measure of such participation to be used along with the other data generated more specific to other outcomes in the plan. Over the course of the rehabilitation process, it may be anticipated that the objectives set for such participation may also be revised in concert with the client.

The structure for such planning already exists in the legislative mandate for client participation in the individual rehabilitation plan. As pointed out in another portion of this overall OTA report, the methodology for such participation has not been widely implemented. Nor have data potentially available from a sampling of these plans been systematically collected. Such

data as to the measured effectiveness of specified services in meeting specified outcomes are a major need both for policy decisions as well as for the continued development of counsellors in aiding their clients on an individual level. Such an approach at the individual planning level integrated into a management information system would then provide: the data base to which services and other technologies are both potentially required and actually prescribed, their effectiveness in meeting an array of objectives, and the effectiveness of the planning/resource allocation technique itself in increasing the effectiveness of the entire system.

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Addendum:

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